

Astrobiology at JPL and the Search for Life in the Universe

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Astrobiology is a new program at JPL in which an environmental microbiology group is being assembled to interact with mission scientists on issues such as mission design, in situ measurements, and sample return handling and analysis. This is an agency-wide program, and the group at JPL has defined its own roles within this very large program. These include studies of life on Earth, studies of the primitive geology and geochemistry of the Earth, and studies of ancient and modern Mars, with the goal of assisting sample acquisition and analysis from Mars, and perhaps elsewhere.

The Earth studies include: (a) the study of extreme environments on Earth, with a focus on alkaline ecosystems, cold ecosystems, dry ecosystems, and deep subsurface environments. (b) The study of genomic properties of extant organisms, with the goal of assessing some of the earliest metabolism on Earth. (c) Studies of early Earth geology. In addition, an effort will be made to assess the early metabolism and its effects on early Earth geology, with the goal of identifying those aspects of early biology that drove, or were driven by conditions on the early Earth.

Along with the studies of early Earth will be a concerted effort at the development of biosignatures, so defined as those traces left by living organisms that indicate past (or even present) life. The development of a wide range and type of biosignatures will allow us to examine a variety of different environments on Earth for the presence of subtle signals of life, to test the methods carefully, and to further develop the methods for the analysis of in situ and returned samples. Some of the biosignatures being developed include (a) new approaches to isotope fractionation; (b) rock and mineral weathering as a biosignature; and, (c) x-ray microscopy as a tool for looking on and in rocks for the presence of living or fossil microbes.